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PATENT
Docket No. 361752000500

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the application of:

Keunsuk P. CHANG et al.

Serial No.: 09/715,013

Filing Date: Nov. 20, 2000

For: BIAXIALLY ORIENTED POLYPROPYLENE METALLIZED FILM FOR PACKAGING

Examiner: Kimberly T. Nguyen

Group Art Unit: 1774

SUPPLEMENTAL DECLARATION OF KEUNSUK P. CHANG

Commissioner for Patents
Washington, D.C. 20231

Sir:

Keunsuk P. Chang declares under penalty of perjury under the laws of the United States of America as follows:

1. I am a citizen of the United States of America, residing at 31 Mayflower Court, North Kingstown, RI 02852. I am a co-inventor of the invention as described and claimed in this application. I received a Bachelor's degree in Chemical Engineering in 1983 from Princeton University and a Master's degree in Chemical Engineering from the University of Connecticut in 1985. After graduation, I worked at Mobil Chemical Company Films Division until 1995, working in various assignments in product development and manufacturing. In September 1996, I joined Toray Plastics (America), Inc. (a subsidiary of Toray Industries) and have been at Toray Plastics (America), Inc. in product development since. Currently I am Product Development Manager for the Torayfan division of Toray Plastics (America), Inc.

dc-330943

2. I have reviewed the Office Action of July 17, 2002. In this declaration I would like to explain the specific conditions necessary to produce a discharge-treated surface having at least 0.3% nitrogen functional groups and to explain, based on my experience and testing done at Toray Plastics, why the conditions disclosed in Tsuchiya, U.S. Patent No. 5,137,955, do not produce a discharge-treated surface having at least 0.3% nitrogen functional groups. The data discussed below is drawn from internal studies at Toray Plastics that have not been disclosed publicly and were conducted in May and August of 2000. Our studies of corona discharge-treatment of polypropylene substrates in air and in a N_2/CO_2 blend showed us that use of corona discharge in air does not result in the desired nitrogen functional group concentration at the substrate surface. We have also found that flame treatment in air also does not result in nitrogen functional groups at the substrate surface. This is because the oxygen in air, with exposure to corona discharge, forms oxygen radical groups which react preferentially on the substrate surface, forming carbon-oxygen functional groups more favorably than carbon-nitrogen functional groups. Thus, controlling the oxygen content to a minimum level is a critical parameter to generating nitrogen functional groups on the substrate surface. In a N_2 or CO_2/N_2 atmosphere for corona-discharge treatment, measures must be put into place to prevent O_2 from "contaminating" the atmosphere. These countermeasures include engineering designs of the discharge-treatment chamber to exclude air infiltration, oxygen sensors to monitor the amount of O_2 present in the chamber, specifying N_2 and CO_2 gas purity from vendors, etc. In a CO_2 atmosphere as disclosed in Tsuchiya at column 6, lines 3-6, since no nitrogen is present, no nitrogen functional groups can be generated.

3. Table 1 summarizes nitrogen functional groups and atomic nitrogen concentrations obtained by using corona-discharge treatment in air, in a N_2/CO_2 atmosphere with no oxygen present, and in a N_2/CO_2 atmosphere contaminated with air of a polypropylene substrate. The presence of these functional groups and their concentrations are determined by Electron Spectroscopy for Chemical Analysis (ESCA) examination of the treated substrate surface.

Table 1

(in atomic %)

	C	O	N	(C,H)-N
In Air	91.9	7.9	0.0	0.0
In N_2/CO_2	90.4	9.0	0.5	0.5
In N_2/CO_2 contaminated with air	89.8	10.2	0.0	0.0

The ESCA analysis shows that the corona-treatment discharge of polypropylene film in a N_2/CO_2 atmosphere typically produces 0.5 atomic weight % nitrogen on the surface of the film. Typical amounts in our various studies range from 0.3% to 0.9%. For the most part, these nitrogen concentrations are in the form of primary amine groups (C,H)-N although quaternary amine groups $(C,H)_4\text{-}N^+$ and nitrate ions NO_3^- have also been detected. When the same substrate is corona-treated in air, however, no nitrogen and thus no nitrogen-containing functional groups are detected. This is likely due to the fact that competing oxygen radicals are favored over nitrogen radicals. Indeed, when a N_2/CO_2 blend atmosphere is contaminated by oxygen (i.e. air contamination) due to a leak in the treater cabinet, no nitrogen functional groups are detected.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct. Executed at North Kingstown, RI, USA, this 26th day of August, 2002.

Keunsuk P. Chang